Translator's note re "Implant for insertion…"

Claim 25

"according to claim or 24" should be "according to claim 23 or 24"

Implant for insertion between vertebrae of the spinal column

The invention relates to an implant for insertion between vertebrae of the spinal column, as a substitute for disks, vertebrae, or parts of vertebrae removed from the spinal column, having a first implant part and a second implant part, which are adjustable, relative to one another, in the direction of their coaxial longitudinal axes, to change the length of the implant.

An implant of this type is known, for example, from DE 44 23 2057 A1, which implant has proven itself in practice and is characterized by the simple possibility of distraction inherent in it, which is achieved in that the two end implant parts that are arranged on the center implant part are screwed into the center implant part by way of their threaded connection and thereby are adjusted in height in the manner of a spindle. However, it must be noted that a relatively great space requirement is needed for the distraction, in order to be able to pivot a tool during the operation and thereby to rotate the implant parts relative to one another.

The invention is therefore based on the task of developing an implant of the type stated initially further, in such a manner that an individual adjustment of the implant to the conditions prevailing *in situ* is possible, for simplification of inventory with regard to making different size implants available, and facilitation of the distraction that is to be performed during the operation.

This task is accomplished, according to the invention, by means of an implant of the type stated initially, which is characterized by a joining plate that can be connected with the free end of at least one of the two implant parts, in an essentially perpendicular alignment relative to the longitudinal axis, by means for releasable attachment.

This implant is connected with the advantage that the length expanse of the implant can be changed in simple manner, by means of the joining plate, so that the implant itself must already be made available in a less precise gradation, and furthermore an enlargement of the range that can be covered with regard to the desired length change of the distraction is present; the extent of

the distraction with the required reciprocal adjustment of the implant parts is reduced by the thickness of the joining plate.

For this reason, it is advantageous if the thickness of the joining plate corresponds to 2.0% to 30.0% of the height of one of the implant parts.

A very particularly preferred embodiment of the invention is characterized in that the joining plate projects beyond the outside contour of the implant. This is connected with the great advantage that the effective active cross-section of the implant is no longer solely determined by its outside contour, but rather can be adapted for variation of the surface pressure, by means of a suitable selection of the size of the joining plate.

For simple handling during the operation, it is decisive, in this regard, that the connection of the joining plate with the implant can be produced and released again in simple manner. For this purpose, it is advantageous if the means for releasable attachment comprise an opening formed in the joining plate, so that a plug-in connection can be produced in the simplest possible manner, by means of setting the joining plate onto the implant with its opening. In this regard, the joining plate is preferably set onto the implant on the outside, so that the shape of the opening is adapted to the outside contour of the implant.

According to an alternative of the invention, it is provided that the opening is configured in the center of gravity of the joining plate, so that a symmetrical configuration with reference to the longitudinal axis of the implant is obtained.

However, there is also the possibility that the opening is configured to lie outside of the center of gravity of the joining plate, in order to thereby be suitable for situations in which a support surface of the vertebra provided by the implant is desired to be enlarged on one side, as can be the case, for example, if the implant is used in twos, in pairs, in order to bridge the spinal column gap between two vertebrae.

An improved contact surface between the implant and the vertebra is made available in that the surface of the joining plate that faces the vertebra is domed in convex manner.

An embodiment that is characterized in that the joining plate is provided with the means for attachment in duplicate and is assigned to one of the implant parts, in each instance, is very particularly preferred, within the scope of the invention, since in this way, the advantages of the invention can be utilized for every vertebra that is adjacent to the implant.

In order to make the handling of the implant having the joining plate as simple as possible under the conditions of an operation, it is provided that the means for attachment are formed by a plug-in connection that is formed between the joining plate and the implant part and a catch seat. This is possible, for example, in that the means for attachment are formed by a bayonet closure. Alternatively, there is the possibility that the means for attachment comprise a groove formed in the free end of the implant part, as well as a spring mounted in a groove of the opening of the joining plate, which moves back, in resilient manner, when the joining plate is set onto the implant part, and can enter into the groove of the implant part as a catch member.

In order to facilitate reliable anchoring of the implant in the vertebrae, it is possible that mandrels and/or cutting blades are arranged on the side of the joining plate that faces the vertebra.

A particularly great variability of the implant, structured as a modular system, is achieved in that the joining plate is configured as a polygon or, alternatively, in rounded manner, or, alternatively, in star-shaped manner. The star-shaped configuration of the joining plate, in particular, is characterized, in this regard, by the property that the joining plate does not represent a closed surface as a sharp separating plane between the vertebra and the implant arranged below the joining plate. This creates the possibility that an osseous connection will form between the two vertebrae and that the implant can grow into place particularly well, particularly if bone chips, bone cement, or the like is used in supportive manner.

The advantage cited above not only exists if the joining plate is configured in star-shaped manner, but also if a passage opening is formed in the joining plate. In order to facilitate particularly good osseous penetration of the implant, it is practical if the passage opening is provided multiple times.

It is furthermore practical if the passage opening extends to the outer edge of the joining plate, since the accessibility for deposition of bone-building material is simplified in this way, and a larger contact surface, i.e. length for deposition of this material is present.

According to another embodiment of the invention, it is provided that plate ridges that proceed from the opening form and delimit the passage opening. The stability of a joining plate configured in this way is improved in that the plate ridges are connected with one another at their free ends, to form the edge of the joining plate.

Another very particularly preferred embodiment of the invention is characterized in that a rotatable threaded ring is assigned to the first implant part, which engages with a ring thread in a thread assigned to the second implant part, and that the threaded ring is provided with a bevel wheel gearing, since in the case of an implant configured in this manner, the space requirement for changing the length of the implant, in other words the distraction, is reduced by avoiding a pivot movement.

It is practical if, in order to adapt to the anatomical conditions, the side of the joining plate that faces the vertebra and/or the side of the joining plate that faces the implant part is/are oriented at an incline to the longitudinal axis, whereby the angle of incline is between 3° and 45°.

Good adaptation to the anatomy requires that the rotational position of the joining plate can be fixed in place about the longitudinal axis, relative to the implant part, for which purpose is it provided that catch seats are formed between the joining plate and the implant part, in the circumference direction, in step widths from 10° to 45°.

In the following, the invention will be explained in greater detail using exemplary embodiments shown in the drawing; this shows:

Fig. 1 a perspective view of an implant consisting of a first implant part and a second implant part, having two joining plates attached at the free ends of the two implant parts,

Fig. 2 the implant from Figure 1 in a side view,

Fig. 3 a view of an implant corresponding to Figure 1, having joining plates attached to the two implant parts not at their centers of gravity,

Fig. 4 a view corresponding to Figure 2, of the implant of Figure 3,

Fig. 5 a view from the direction of the arrow V from Figure 4,

Fig. 6 a top view of the implant according to Figure 3,

Fig. 7 a view of another alternative embodiment, corresponding to Figure 1,

Fig. 8 a side view of the implant from Figure 7,

Fig. 9 a view of another alternative embodiment, corresponding to Figure 1,

Fig. 10 an isolated perspective view of a joining plate,

Fig. 11 a top view of another joining plate,

Fig. 12 an isolated perspective view of another joining plate,

Fig. 13 an isolated perspective view of another joining plate,

Fig. 14 a top view of another joining plate,

Fig. 15 a top view of another joining plate,

Fig. 16 an isolated perspective view of another joining plate having plate ridges,

Fig. 17 a top view of another joining plate having plate ridges,

Fig. 18 a view of another embodiment of a joining plate, corresponding to Figure 17,

Fig. 19 a view of another embodiment of a joining plate, corresponding to Figure 17,

Fig. 20 an isolated perspective view of another joining plate,

Fig. 21 a view of another embodiment of a joining plate, corresponding to Figure 20,

Fig. 22 a view of another embodiment of a joining plate, corresponding to Figure 20,

Fig. 23 an isolated perspective view of a joining plate adapted to the outside contour of the implant,

Fig. 24 a side view of the joining plate from Figure 23,

Fig. 25 a top view of the joining plate according to Figure 23,

Fig. 26 a view of a joining plate having non-plane-parallel surfaces, corresponding to Fig. 22,

Fig. 27 a side view of the joining plate from Fig. 26,

Fig. 28 a top view of a joining plate,

Fig. 29 the section XXIX-XXIX from Fig. 28,

Fig. 30 a side view of the joining plate from Fig. 20, and

Fig. 31 a view of an implant having two joining plates according to Fig. 28, corresponding to Fig. 1.

Figures 1 and 2 show an implant 1 that serves for insertion between vertebrae of the spinal column, not shown in the drawing themselves, for disks, vertebrae, or parts of vertebrae removed from the spinal column. The implant 1 comprises a first implant part 2 and a second implant part 3, which are adjustable, relative to one another, in the direction of their coaxial longitudinal axes, to change the length of the implant 1. In the exemplary embodiment shown in the drawing, a rotatable threaded ring 4 is assigned to the second implant part 3, which engages with a ring thread in a thread assigned to the first implant part 2, whereby the threaded ring 4 is provided with a bevel wheel gearing, so that a second bevel wheel set against the bevel wheel gearing can bring about a change in length of the implant 1. The implant 1 furthermore has at least one joining plate 5, a total of two joining plates 5 in the exemplary embodiment shown that can be connected with the free end of the two implant parts 2, 3, in an essentially perpendicular alignment relative to the longitudinal axis, by means for releasable attachment. The joining plate 5 is therefore provided with means for attachment in duplicate, and assigned to one of the implant parts 2, 3, in each instance, whereby the thickness of the joining plate 5 corresponds to 2.0% to 30.0% of the height of one of the implant parts 2, 3, so that a change in the length of the implant 1 can essentially be brought about by the joining plate 5, particularly by the one shown in isolated manner in Figures 23 to 24, while the other joining plates 5 shown in the drawing are characterized in that they project beyond the outside contour of the implant 1 and thereby make available a larger contact surface relative to the adjacent vertebra for the implant 1.

The means for releasable attachment comprise an opening 6 formed in the joining plate, which is adapted to the outside contour of the implant 1, so that the joining plate 5 can be set onto the

implant 1 in the simplest possible manner. In the case of the exemplary embodiment shown in Figures 1 and 2, for example, the opening 6 is configured in the center of gravity of the joining plate 5, while Figures 3 to 6 show an embodiment in which the opening 6 is configured outside of the center of gravity of the joining plate 5.

In this regard, Figures 2 and 5 show that the surface 7 of the joining plate 5 that faces the vertebra is domed in convex manner.

Figures 23 to 25 show that the plug-in connection is supplemented with a catch seat, specifically formed, in concrete terms, by means of a groove formed at the free end of the implant part 2, 3, as well as by a spring 9 mounted in a groove 8 of the opening 6 of the joining plate 5. Figure 24, in particular, shows that mandrels 10 are arranged on the side of the joining plate 5 that faces the vertebra, which can also be configured as cutting blades with a longer expanse in the circumference direction.

With regard to the configuration of the joining plate 5, there are many different possibilities of variation, in order to be able to take the actual conditions present in a particular operation into account; Figure 10, just like Figure 13, shows an essentially triangular configuration of the joining plate 5, with rounded corners, while Figure 12 shows a rectangular configuration, but in general, any polygon can be implemented, to the extent that this is desirable for anatomical or operative reasons. Figure 11, just like Figures 14 and 15, show a star-shaped configuration of the joining plate 5, in which the regions between plate ridges 11 can be interpreted as passage openings 12, which allow a great approximation to the outside contour of the implant 1 with bone cement, for example, despite the given radial expanse of the plate ridges 11. In total, the varied configuration of the joining plate 5 also serves for better support of the vertebra, by making large-area contact possible. In this way, the majority of the passage openings 12 that are shown embedded in Figure 7 extend to the edge of the joining plate 5 in Figure 11. The embodiments shown in Figures 17 to 22 can be described, in the simplest manner, by means of the plate ridges 11 that proceed from the opening 6 of the joining plate 5, which form and delimit the passage openings, whereby in Figures 21 and 22, the free ends of the plate ridges 11 are connected with one another, to form the edge of the joining plate 5.

Fig. 26 and 27 show that the side of the joining plate 5 that faces the vertebra and the side of the joining plate 5 that faces the implant part 2, 3 are oriented at an incline to the longitudinal axis, so that the implant 1 can be better adapted to the anatomical conditions found, whereby for this purpose, joining plates 5 having an incline angle between 3° and 45° are kept on hand.

In order to permanently assure the good adaptation, the rotational position of the joining plate 5 can be fixed in place about the longitudinal axis, relative to the implant part 2, 3, for which purpose catch seats are formed between the joining plate 5 and the implant part 2, 3, in the circumference direction, in step widths from 10° to 45°.

Claims:

1. Implant for insertion between vertebrae of the spinal column, as a substitute for disks, vertebrae, or parts of vertebrae removed from the spinal column, having a first implant part (2) and a second implant part (3), which are adjustable, relative to one another, in the direction of their coaxial longitudinal axes, to change the length of the implant (1), characterized by a joining plate (5) that can be connected with the free end of at least one of the two implant parts (2, 3), in an essentially perpendicular alignment relative to the longitudinal axis, by means for releasable attachment.

2. Implant according to claim 1, characterized in that the thickness of the joining plate (5) corresponds to 2.0% to 30.0% of the height of one of the implant parts (2, 3).

3. Implant according to claim 1 or 2, characterized in that the joining plate (5) projects beyond the outside contour of the implant (1).

4. Implant according to claim 3, characterized in that the means for releasable attachment comprise an opening (6) formed in the joining plate (5).

5. Implant according to claim 4, characterized in that the shape of the opening (6) is adapted to the outside contour of the implant (1).

6. Implant according to claim 4 or 5, characterized in that the opening (6) is configured in the center of gravity of the joining plate (5).

7. Implant according to claim 4 or 5, characterized in that the opening (6) is configured to lie outside of the center of gravity of the joining plate (5).

8. Implant according to one of claims 1 to 7, characterized in that the surface (7) of the joining plate (5) that faces the vertebra is domed in convex manner.

9. Implant according to one of claims 1 to 8, characterized in that the joining plate (5) is provided with the means for attachment in duplicate and is assigned to one of the implant parts (2, 3).

10. Implant according to one of claims 4 to 9, characterized in that the means for attachment are formed by a plug-in connection formed between the joining plate (5) and the implant part (2, 3), and a catch seat.

11. Implant according to claim 10, characterized in that the means for attachment are formed by a bayonet closure.

12. Implant according to one of claims 4 to 9, characterized in that the means for attachment comprise a groove formed in the free end of the implant part (2, 3), as well as a spring (9) mounted in a groove (8) of the opening (6) of the joining plate (5).

13. Implant according to one of claims 1 to 12, characterized in that mandrels (10) and/or cutting blades are arranged on the side of the joining plate (5) that faces the vertebra.

14. Implant according to one of claims 3 to 13, characterized in that the joining plate (5) is configured as a polygon.

15. Implant according to one of claims 3 to 14, characterized in that the joining plate (5) is configured in rounded manner.

16. Implant according to one of claims 3 to 15, characterized in that the joining plate (5) is configured in star-shaped manner.

17. Implant according to one of claims 3 to 16, characterized in that a passage opening (12) is formed in the joining plate (5).

18. Implant according to claim 17, characterized in that the passage opening (12) is provided multiple times.

19. Implant according to claim 18, characterized in that the passage opening (12) extends to the outer edge of the joining plate (5).

20. Implant according to claim 18 or 19, characterized in that plate ridges (11) that proceed from the opening form and delimit the passage opening (12).

21. Implant according to claim 20, characterized in that the plate ridges (11) are connected with one another at their free ends, to form the edge of the joining plate (5).

22. Implant according to one of claims 1 to 21, characterized in that a rotatable threaded ring (4) is assigned to the second implant part (3), which engages with a ring thread in a thread assigned to the first implant part (2), and that the threaded ring (4) is provided with a bevel wheel gearing.

23. Implant according to one of claims 1 to 22, characterized in that the side of the joining plate (5) that faces the vertebra is oriented at an incline to the longitudinal axis.

24. Implant according to one of claims 1 to 23, characterized in that the side of the joining plate (5) that faces the implant part (2, 3) is oriented at an incline to the longitudinal axis.

25. Implant according to claim or 24, characterized in that the angle of incline is between 3° and 45°.

26. Implant according to one of claims 23 to 25, characterized in that the rotational position of the joining plate (5) can be fixed in place about the longitudinal axis, relative to the implant part (2, 3).

27. Implant according to claim 26, characterized in that catch seats are formed between the joining plate (5) and the implant part (2, 3), in the circumference direction, in step widths from 10° to 45°.

Title of the invention

Implant for insertion between vertebrae of the spinal column

Abstract

The invention relates to an implant for insertion between vertebrae of the spinal column, as a substitute for disks, vertebrae, or parts of vertebrae removed from the spinal column. The implant (1) possesses a first implant part (2) and a second implant part (3), which are adjustable, relative to one another, in the direction of their coaxial longitudinal axes, to change the length of the implant (1), as well as a joining plate (5) that can be connected with the free end of at least one of the two implant parts (2, 3), in an essentially perpendicular alignment relative to the longitudinal axis, by means for releasable attachment.

(Fig. 1)